A 194.

R. A. 22^h 57^m 28^s; Decl. +47° 28'.

| 1900.94 | 97°.7 | 0".18 | 8.0–8.0 | 4^n. |

Three of the pairs discovered since the lists mentioned above were printed consist of additional components to previously known double stars.

Their measures are as follows: —

R. A. 19^h 7^m 43^s; Decl. + 24° 23' (1880.0).

A and *B* (New).

| 1901.35 | 288°.6 | 2".79 | 8.0–13.5 | 3^n. |

A and *C* = Ho. 446.

| 1901.35 | 48°.3 | 5".32 | 8.0–12.0 | 3^n. |

A and *D* (New).

| 1901.35 | 112°.0 | 33".6 | 8.0–15.5 | 1^n. |

D and *E* (New).

| 1901.35 | 118°.8 | 5".38 | 15.5–16.0 | 1^n. |

R. A. 20^h 3^m 38^s; Decl. +35° 26' (1900.0).

A and *B* = OΣ 398.

| 1901.53 | 77°.3 | 0".96 | 7.7–9.7 | 1^n. |

A and *C* (New).

| 1901.53 | 132°.0 | 5".23 | 7.7–15.0 | 1^n. |

R. A. 20^h 7^m 25^s; Decl. +34° 7' (1880.0).

A and *B* (New).

| 1901.41 | 206°.2 | 0".21 | 7.6–7.8 | 3^n. |

AB and *C* = Ho. 121.

| 1901.40 | 17°.0 | 22".80 | 7.0–11.5 | 2^n. |

September 5, 1901.   R. G. Aitken.

Some Recent Results Secured with the Mills Spectrograph.*

The results given below are a few of those recently established by the Mills spectrograph, used in connection with the 36-inch refracting telescope. The majority of the photographs upon which the results depend were made by Assistant Astronomer W. H. Wright, and the remainder by Dr. Reese and myself.

June 20, 1901.   W. W. Campbell.

* Reprinted from *Bulletin* No. 4 of the Lick Observatory.

I.—A LIST OF SIX STARS WHOSE VELOCITIES IN THE LINE OF
SIGHT ARE VARIABLE.

The following six spectroscopic binaries, discovered with the
Mills spectrograph, are additional to the twenty-five already
announced.

π *Cephei* ($a = 23^h\ 05^m;\ \delta = +\ 74°\ 51'$).

The binary character of this star was suspected in August,
1899, from the fact that the approximate measures and reduc-
tions of the first and third plates showed a range of four kilo-
meters in the observed velocities. Later plates confirmed the
fact of the variation. The observations to date are as follows :—

Date.		Velocity.
1899 August	8	$-\ 33^{km}$
August	23	$-\ 36$
August	29	$-\ 37$
1900 October	7	$-\ 5$
December	24	$-\ 23$

$o_1\ 31$ *Cygni* ($a = 20^h\ 10^m;\ \delta = +\ 46°\ 26'$).

The variability was detected in July, 1900, from the third
plate.

Date.		Velocity.
1899 June	20	$-\ 12^{km}$
July	2	$-\ 11$
1900 July	30	$-\ 3$
August	12	$-\ 3$
October	7	$\pm\ 0$
1901 June	5	$+\ 3$

This star was discovered to have a composite spectrum by
Harvard College Observatory. [*Annals H. C. O.*, XXVIII,
93.]

ξ *Piscium* ($a = 1^h\ 48^m;\ \delta = +\ 2°\ 42'$).

The variable velocity of this star was discovered in September,
1900, from measures of the third plate.

Date.		Velocity.
1899 September	5	$+\ 25^{km}$
September	19	$+\ 27$
1900 September	17	$+\ 33$
December	26	$+\ 35$

τ *Persei* ($a = 2^h\ 47^m$; $\delta = 52°\ 22'$).

The variable velocity of τ *Persei* was discovered from the fourth plate of its spectrum in October, 1900.

Date.		Velocity.
1898 October	26	$+ 10^{km}$
November	14	$+ 8$
November	28	$+ 8$
1900 October	15	$- 2$
October	31	$- 3$
December	17	$- 4$

It was discovered at Harvard College Observatory that this star has a composite spectrum. [*Annals H. C. O.*, XXVIII, 93.]

ξ_1 *Ceti* ($a = 2^h\ 08^m$; $\delta = 8°\ 23'$).

The variable velocity of this star was discovered from the fourth plate in October, 1900.

Date.		Velocity.
1897 October	27	$- 9^{km}$
1898 October	10	$- 7$
October	17	$- 8$
1900 October	29	$+ 4$
December	4	$+ 1$

ϵ *Hydræ* ($a = 8^h\ 42^m$; $\delta = + 6°\ 48'$).

The variable velocity of this star was detected from the third plate in December, 1900.

Date.		Velocity.
1899 November	27	$+ 43^{km}$
December	26	$+ 43$
1900 December	3	$+ 35$
December	24	$+ 40$
1901 April	23	$+ 32$

II.—RADIAL VELOCITIES IN THE SYSTEM OF δ *EQUULEI.*

This is one of the most interesting double stars known, discovered by OTTO STRUVE in 1852. Its period of revolution was supposed to be 11.4 years. It was placed on the observing program for the Mills spectrograph, and its radial velocity was observed as follows :—

Date.		Velocity.
1900 June	25	$- 14^{km}$
July	9	$- 13$

No peculiarities, such as doubling of the lines due to the two components, were apparent in the spectrum. This result was anticipated, as the two components were known to be moving approximately parallel to the line of nodes of their orbit; that is, at right angles to the line of sight.

In September, 1900, Assistant Astronomer AITKEN's observations of this star showed that the long-accepted orbits were unsatisfactory [*Publ. A. S. P.*, XII, 255-7]; and Astronomer HUSSEY's investigations rendered it probable that the period is only 5.7 years [*Publ. A. S. P.*, XII, 215-223].

Special efforts have been made to secure spectrographic observations of δ *Equulei* this spring, with a view to solving the difficult question of the star's period. A few successful negatives have been obtained in the past two months. The spectra of the two components are clearly shown, with displacements corresponding to a relative velocity at present of about 35 kilometers per second. If the distance between the corresponding lines decreases, and vanishes, in the next few months, we shall have conclusive proof that the period of the star is in the vicinity of 5.7 years; otherwise, the longer period should have the preference.

III.—RADIAL VELOCITIES IN THE SYSTEM OF *POLARIS*.

It was discovered in August, 1899, from observations made with the Mills spectrograph, that α *Ursæ Minoris (Polaris)* is a triple star. A few observations secured that month showed at once that the bright component was moving around the center of mass of itself and an invisible companion in a period of about 3 days 23 hours. Six observations secured in 1896, extending over three months, were best satisfied on the assumption that the period is $3^d\ 23^h\ 15^m$. A comparison of the 1896 and 1899 observations furnished a period of $3^d\ 23^h\ 14^m.3$.

The velocity of the center of mass of this system varied from -18.0^{km} per second in 1896 to -11.8^{km} in 1899; thereby affording proof that this system was revolving around the center of mass of itself and a third body in a relatively long period of time.

Further observations have been secured at intervals since August, 1899, for the purpose of detecting the first evidence of change in velocity of the center of mass of the short-period system. Changes suspected in the latter half of 1900 have now

become certain : the velocity of the center of mass of the binary system has varied from — 11.8^{km} in 1899 to about — 13.5^{km} at the present time.

The period of the binary system, 3^d 23^h $14^m.3$, deduced in 1899, seems to satisfy recent observations perfectly.

IV.—THE RADIAL VELOCITY OF α *PERSEI.*

Mr. H. F. NEWALL, from observations made at Cambridge, England, has announced [*The Observatory*, December, 1900] that the velocity of α *Persei* is variable.   His results lie between — 4 and + 8^{km} per second, and were secured in the years 1899 and 1900.

The following table contains all the Mills spectrograph observations of this star, with the time-intervals between successive dates : —

Date.		Velocity.	Interval.
1896 November	11	— 2.0^{km}	
November	12	— 1.8	1 day
1897 January	19	— 3.5	68
1898 July	12	— 2.1	539
1899 September	25	— 1.5	440
1900 December	16	— 2	447
December	26	— 2	10
December	30	— 2	4
December	30	— 3	0
1901 January	13	— 2	14

These ten observations, made in six different years, exhibit a range of only two kilometers.   Since this is about the usual range for such stars, due largely to changes in the observer's personal habits in measuring the plates, we may say that these observations afford no evidence of variable velocity.

V.—THE RADIAL VELOCITY OF θ *URSÆ MAJORIS.*

Observations of this star at Pulkowa in the years 1894 and 1896 by Dr. BELOPOLSKY gave results ranging from + 1^{km} to + 22^{km} per second; and it was announced as a spectroscopic binary with period of from five to seven days. [*Astr. Nach.*, No. 3549 ; *Astroph. Jour.*, XI, 383.]   Results obtained by the same observer in February and March, 1899, ranging from + 7^{km} to + 19^{km}, were considered by him to furnish no evidence of variable velocity during those months [*Astr. Nach.*, No. 3603].

The Mills spectrograph observations, as published below, do not indicate variable velocity.

Date.		Velocity.
1897 November	16	$+$ 15 $\pm$ ^{km}
1899 December	18	$+$ 16
December	24	$+$ 15
December	27	$+$ 14
1900 January	30	$+$ 14
1901 January	27	$+$ 14

VI.—THE VARIABLE VELOCITY OF δ *ORIONIS* IN THE LINE OF SIGHT.

The variable velocity of this star was discovered by M. H. DESLANDRES from observations made with the great Meudon refractor. This star is not on the programme for the Mills spectrograph, as its lines are very broad and unsuitable for accurate measurement. However, Mr. WRIGHT has secured three observations, as below, which confirm M. DESLANDRES' discovery.

Date.		Velocity.
1900 August	12	$+$ 3^{km}
August	21	$+$ 51
September	17	$-$ 69

OBSERVATIONS OF THE SATELLITES OF *URANUS* IN 1900 AND 1901.

The present great south declination of *Uranus* makes observations of its faint satellites difficult in northern observatories even under the best conditions, and worthless when the conditions are poor. On this account a comparatively small number of measures, especially of the two inner satellites, *Ariel* and *Umbriel*, was secured during the last two oppositions of the planet. For of the nights when the 36-inch telescope was available to me, I used for this work only those on which the satellite measured could be seen continuously during the time of observation, and on which the image of *Uranus* was sufficiently steady and well-defined to permit accurate bisections to be made with the micrometer-wire.

The detailed observations with notes on the relative brightness of the satellites and a comparison of the observed positions with those derived from NEWCOMB'S Tables (Washington Observations for 1873—Appendix I) are published as *Bulletin* No. 7 of the Lick Observatory.